

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

U.S. APPLICATION NO. (If known see 37 C.F.R. 1.5)

09/555544

INTERNATIONAL APPLICATION NO.

INTERNATIONAL FILING DATE

(EARLIEST) PRIORITY DATE CLAIMED

PCT/GB98/03636**December 7, 1998****December 5, 1997**

TITLE OF INVENTION

MATERIAL DEPOSITION

APPLICANTS FOR DO/EO/US

Kwang-Leong CHOY and Isaac CHANG

Applicants herewith submit to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)), including _____ sheets of formal drawings and a copy of the International Search Report.
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☒ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventors (35 U.S.C. 371(c)(4)).
10. ☐ The annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☐ Other items or information:

References for IDS

Check No. 10448 for \$984.00 for filing fee

PCT/IPEA/409,416

PCT/ISA/210

PCT/RO/101,105

PCT/IB/301,304

EXPRESS MAILMailing Label Number: EL560704650USDate of Deposit: June 1, 2000

I hereby certify that this paper or fee is being deposited with the United States Postal Service

"Express Mail Post Office to Addressee" Service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents and Trademarks, Box PCT Washington, DC 20231.

Edward Nay
(Typed or printed name of person mailing paper or fee)[Signature]
(Signature of person mailing paper or fee)

09/55554417. ☒ The following fees are submitted:**Basic National Fee (37 CFR 1.492(a)(1)-(5)):**

Search Report has been prepared by the EPO or JPO.....\$840.00 (\$840.00)

International preliminary examination fee paid to USPTO (37 CFR 1.482) ()
.....\$700.00 ()No international preliminary examination fee paid to USPTO (37 CFR 1.482) ()
but international search fee paid to USPTO (37 CFR 1.445(a)(2))...\$770.00 ()Neither international preliminary examination fee (37 CFR 1.482) nor ()
international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....\$1040.00 ()International preliminary examination fee paid to USPTO (37 CFR 1.482) ()
and all claims satisfied provisions of PCT Article 33(2)-(4).....\$96.00 ()

ENTER APPROPRIATE BASIC FEE AMOUNT = (\$840.00)

Surcharge of **\$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 (\$ /
months from the earliest claimed priority date (37 CFR 1.492(e)).

28 Claims /Number Filed / Number Extra /Rate (

Total Claims / 28 - 20 = / 8 /X \$18.00 (\$144.00/Independent Claims / 2 - 3 = / 0 /X \$78.00 (\$ /

Multiple dependent claim(s) (if applicable) /+ \$260.00 (\$ /

TOTAL OF ABOVE CALCULATIONS = (\$984.00/Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity (/
statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28). (/**SUBTOTAL =** (\$984.00/Processing fee of **\$130.00** for furnishing the English translation later than (/
☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).+ (\$ /**TOTAL NATIONAL FEE =** (\$984.00/Fee for recording the enclosed assignments (37 CFR 1.21(h)). The assignment (\$ /
must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property + (\$ /**TOTAL FEES ENCLOSED =** (\$984.00 /(Amount to be: /
(refunded) /\$
(charged) /\$

- a. ☒ Our checks in the amount of \$984.00 to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. 50-0320 in the amount of \$_____ to cover the above fees.
A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-0320. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

THOMAS J. KOWALSKI, ESQ.
FROMMER LAWRENCE & HAUG LLP
745 FIFTH AVENUE
NEW YORK, NEW YORK 10151

SIGNATURE

THOMAS J. KOWALSKI
 NAME

32,147
 REGISTRATION NUMBER

Dated: June 1, 2000

Form PTO-1390 (REV 10-96)

422 Rec'd PCT/PTO

21 JUN 2000

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s) : CHOY et al.
 Serial No. : NOT YET ASSIGNED
 For : MATERIAL DEPOSITION
 Filed : HEREWITH

745 Fifth Avenue
 New York, NY 10151

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Date of Deposit: June 1, 2000

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" Service under 37 CFR 1.10 on the date indicated above and is addressed to: Assistant Commissioner for Patents, Washington, DC 20231 Box New Patent Application

Edward Nay

(Typed or printed name of person mailing paper or fee)

Edward Nay

(Signature of person mailing paper or fee)

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
 Washington, D.C. 2023

Sir:

Prior to examination and fee calculation, and without any prejudice, admission, surrender of subject matter, or any intention of creating any estoppel as to equivalents, kindly amend the application as follows:

IN THE CLAIMS

Please amend the claims, without any prejudice, without any surrender of subject matter, without any intention of creating any estoppel as to equivalents, and without any admission, as follows:

Claim 2, line 1, after "wherein", please insert --the delivering is from a first outlet and--.

Claim 4, line 1, please delete "or 3".

Claim 5, line 1, please change "any of claims 1 to 4" to --claim 1--.

Claim 6, line 1, please change "any of claims 1 to 5" to --claim 1--.

Claim 6, line 2, please delete "first".

7. (Amended) The method according to claim [6 when appendant upon claim] 2, wherein the method further comprises the step of delivering a flow of cold gas in the dircetion from the outlet towards the substrate and the flow of cold gas is delivered from a third outlet as an annular flow about the stream of droplets and within the annular flow of fuel.

Claim 9, line 1, please change "any of claims 1 to 8" to --claim 1--.

Claim 10, line 1, please change "any of claims 1 to 9" to --claim 1--.

Claim 11, line 1, please change "any of claims 1 to 10" to --claim 1--.

Claim 12, line 1, please change "any of claims 1 to 11" to --claim 1--.

Claim 13, line 1, please change "any of claims 1 to 12" to --claim 1--.

Claim 14, line 1, please change "any of claims 1 to 13" to --claim 1--.

Claim 15, line 1, please change "any of claims 1 to 14" to --claim 1--.

Claim 16, line 1, please change "any of claims 1 to 14" to --claim 1--.

Claim 20, line 1, please delete "or 19".

Claim 22, line 1, please change "any of claims 18 to 21" to --claim 18--.

Claim 23, line 1, please change "any of claims 17 to 22" to --claim 17--.

Claim 24, line 1, please change "any of claims 17 to 23" to --claim 17--.

Claim 26, line 1, please change "any of claims 17 to 25" to --claim 17--.

Claim 27, line 1, please change "any of claims 17 to 26" to --claim 17--.

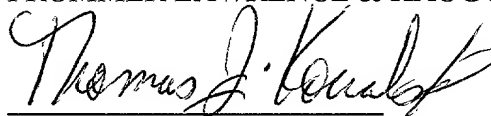
Claim 28, line 1, please change "any of claims 17 to 26" to --claim 17--.

REMARKS

This Amendment removes multiple dependencies, without any prejudice, admission, intention of creating any estoppel as to equivalents, and without any surrender of subject matter. Early and favorable examination on the merits is earnestly solicited.

Respectfully submitted,
FROMMER LAWRENCE & HAUG LLP

By:



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14-02-2000

ART 34 AMDT

1

MATERIAL DEPOSITION

This invention relates to material deposition, for example, as a film or layer on a substrate or as a powder.

The application of materials such as ceramics as structural coatings and functional electronic films is expanding rapidly. Various desposition techniques such as chemical vapour deposition (CVD), physical vapour deposition (PVD), flame synthesis deposition (FSD), combustion chemical vapour deposition (CCVD) and sol-gel deposition have been developed or investigated.

Both CVD and PVD techniques involve the use of sophisticated and expensive deposition chambers and/or vacuum systems. The application of CVD and PVD techniques to deposit ceramic films is limited to coating processes in which the film thicknesses and coating areas are relatively small.

It is often difficult to control the stoichiometry of multicomponent oxide films deposited by CVD techniques, and problems can also arise due to differences in the vapour pressures of the CVD reagents and the low growth rate of CVD films.

PVD techniques such as radio frequency (RF) sputtering tend to give low deposition rates and poor yields, and reactive magnetic sputtering and ion beam sputtering need expensive equipment and skilled operators.

FSD techniques produce films with a morphology, microstructure and electrical properties which are dependent on the temperature of the substrate, the coating concentration, the carrier gas flow rate and so on. Control of all of these variables to achieve a desired coating is difficult.

Reference is also made to Hunt *et al*, Applied Physics 63 (1993), No 2, pages 266 to 268, WO-A-97/21848, GB-A-2192901, GB-A-2162861, EP-A-0103505, US-A-5652021, US-A-5534311 and SE-A-9504410.

This invention addresses these problems by providing a deposition technique which at least alleviates some of the disadvantages of the prior art.

This invention provides a method of depositing material on a substrate, comprising the steps of: delivering from an outlet a stream of droplets of a precursor liquid towards a substrate; applying an electric field between the outlet and the substrate; and generating a flame between the outlet and the substrate such that at least

a portion of the stream of droplets of the precursor liquid passes through the flame before reaching the substrate and the precursor liquid is chemically reacted and/or decomposed to provide the deposited material.

This invention also provides an apparatus for depositing material on a substrate, comprising: a substrate holder for holding a substrate; a nozzle assembly including an outlet from which a stream of droplets of a precursor liquid is in use delivered to a substrate; a precursor supply for supplying a precursor liquid to the nozzle assembly; an electrical supply for applying an electric field between the outlet and the substrate; and a burner for generating a flame between the outlet and the substrate and being configured such that in use at least a portion of the stream of droplets of the precursor liquid passes through the flame before reaching the substrate and the precursor liquid is chemically reacted and/or decomposed to provide the deposited material.

In a preferred embodiment the material is a ceramic material.

This invention provides a new technique which, in at least preferred embodiments, involves spraying atomised precursor droplets into a flame while providing an electric field between the precursor outlet and the substrate, so that the precursor forms a charged aerosol which undergoes combustion and/or chemical reaction in the vapour phase in the vicinity of the substrate and allows for the formation of a stable solid film with good adhesion to the substrate.

This invention will now be described, by way of example only, with reference to the accompanying drawings, throughout which like parts are described by like references, and in which Figure 1 is a schematic diagram of a deposition apparatus.

Figure 1 schematically illustrates a deposition apparatus comprising a coaxial nozzle assembly 10 having a liquid precursor delivery capillary 20, a first coaxial passage 30 for cold air, nitrogen or other gases, and a second coaxial passage 40 for liquid or gaseous fuel.

The precursor can be, for example, one of the precursors listed in WO-A-97/21848, with or without the mentioned catalyst. Many other precursors can be used as appropriate for the desired deposition, such as precursors known from FSD techniques as disclosed by Choy in "Flame Assisted Vapour Deposition of Ceramic

Films and Coatings", British Ceramic Proceedings, The Institute of Materials (1995), pages 65 to 74.

The fuel may be a mixture of oxygen and acetylene, or another appropriate fuel, such as fuels known from FSD techniques.

5 A high voltage source 45 maintains an electric field between the nozzle assembly 10 and a substrate 50. The potential difference may be, for example, within the approximate ranges described in WO-A-97/21848, typically in the approximate range of from 5 to 30 kV.

10 The precursor liquid is sprayed towards a region 55 of the substrate 50 from an outlet 60 of the capillary 20. The fuel is ignited so that an annular combustion region 70 is generated. The extent of this combustion region can be controlled by controlling the fuel flow rate, the distance between the nozzle assembly 10 and the substrate 50, the amount and flow rate of cold gases in the passage 30, and the applied electric field.

15 Decomposition and/or chemical reaction of the precursor, for example, a sol-gel transition, occurs in a higher temperature overlap zone between the spray of precursor from the outlet 60 of the capillary 20 and the combustion region 70. Deposition occurs in or beneath this overlap zone. So, by controlling the extent of the combustion region as described above, the deposition on the substrate 50 can be controlled, and premature reaction or decomposition, which is a problem in many prior
20 art FSD techniques leading to non-uniform deposition, can be avoided.

Either polarity of electric field can be used, or a periodically or occasionally alternating field can be employed. A thermocouple can be used to monitor the temperature of the substrate 50.

25 The apparatus preferably includes a mesh 90 which assists in removing soot from the flame and so provide a high temperature (blue) flame.

The apparatus preferably includes a further annular electrode 100 connected to the high voltage supply 45 at an intermediate potential between that of the nozzle assembly 10 and the substrate 50 to steer the material being deposited onto a required area of the substrate 50.

30 The technique is also applicable to premixed fuel and precursor systems. However, non-premixed systems are preferred as these systems give greater control of the deposition temperature and assist in avoiding premature decomposition.

14-02-2000

The technique can be used to manufacture metal oxide and non-oxide materials; to manufacture pure, doped, multicomponent or multiphase materials; to manufacture materials with dense, porous, or a combination of dense and porous structures; to manufacture composite, multilayer and compositionally-graded structures; to produce thin or thick films; for rapid prototyping of net shape and near net shape components; or to coat planar or tubular substrates or other complex shaped components.

The technique can be scaled up for large area or mass production by using multiple flame/electrostatic units. For accurate deposition and process control, the process can be automated.

The substrate 50 can be conductive or non-conductive. For non-conductive substrates, the conductivity can be improved by utilizing a conductive backing holder.

The technique can be performed in an open atmosphere or in an inert/controlled atmosphere. For example, oxide-based structures can be deposited in an open atmosphere, and non-oxide structures, such as sulphides, carbides, etc, can be deposited in a controlled atmosphere. Deposition can take place at atmospheric or a different pressure.

The chemistry of the precursors can be adjusted so that once the chemical reaction starts to take place, a self-assisted reaction occurs. This can reduce the requirements for fuel, while still achieving the required deposition temperature for a particular material.

The electric field reduces the loss of precursor to the surroundings by directing the precursor to the deposition surface. This is a clear advantage over conventional flame-based techniques.

The deposition can be controlled by one or more of the following: the flow rate of the cold gas; the electric field strength; the fuel and its flow rate; the separation of the nozzle assembly from the substrate; the chemistry, concentration and flow rate of the precursor; and the deposition pressure.

Embodiments of the invention allow the use of simple, flexible and/or mobile equipment. The technique can be made relatively safe by the use of sol precursors and/or water based precursors. The process can give rise to an advantageously low flame/deposition temperature for crystalline materials, for example from 550 to 800 °C

for $Y_2O_3-ZrO_2$. Dense films tend to require a sol precursor, whereas porous films may be based on sol or water based precursors. The consumption of precursor can be relatively low, for example, 1 ml of 0.05 M solution to generate a 1 μm film measuring 1 cm x 1 cm. Furthermore, the deposition can be performed in a single step without the need for a subsequent heat treatment.

Powders can be formed by providing for the chemical reaction of the precursor to the solid phase to take place above the substrate 50. With this configuration, the substrate 50 is deposited with discrete powder particles which can be later collected. Powder generation can be improved by employing gas condensation techniques and a cooled collecting substrate.

In a further embodiment, the substrate 50 can be mounted on a movable table or XY positioner under the control of, for example, a computer aided design (CAD) system to allow three-dimensional objects to be constructed layer by layer. This can be used in, for example, rapid prototyping systems.

CLAIMS

1. A method of depositing material on a substrate, comprising the steps of:
 delivering from an outlet a stream of droplets of a precursor liquid towards a substrate;
 5 applying an electric field between the outlet and the substrate; and
 generating a flame between the outlet and the substrate such that at least a portion of the stream of droplets of the precursor liquid passes through the flame before reaching the substrate and the precursor liquid is chemically reacted and/or decomposed to provide the deposited material.
 10
2. The method according to claim 1, wherein the flame generation step comprises the step of delivering from a second outlet an annular flow of fuel about the stream of droplets such as to provide an annular flame combustion region through which at least the portion of the stream of droplets passes before
 15 reaching the substrate.
3. The method according to claim 2, wherein the annular flow of fuel is a diverging flow.
- 20 4. The method according to claim 2 or 3, wherein the first and second outlets are coaxial.
5. The method according to any of claims 1 to 4, wherein the stream of droplets is provided as a diverging spray.
- 25 6. The method according to any of claims 1 to 5, further comprising the step of delivering a flow of cold gas in the direction from the first outlet towards the substrate.

14-02-2000

7

7. The method according to claim 6 when appendant upon claim 2, wherein the flow of cold gas is delivered from a third outlet as an annular flow about the stream of droplets and within the annular flow of fuel.
- 5 8. The method according to claim 7, wherein the first and third outlets are coaxial.
9. The method according to any of claims 1 to 8, wherein the material is a ceramic material.
- 10 10. The method according to any of claims 1 to 9, wherein the material is a multicomponent oxide material.
11. The method according to any of claims 1 to 10, further comprising the step of heating the substrate.
- 15 12. The method according to any of claims 1 to 11, wherein the precursor liquid is a sol precursor solution.
13. The method according to any of claims 1 to 12, further comprising the step of moving one or both of the substrate and the first outlet during deposition so as to deposit a three-dimensional structure as a series of overlying layers.
- 20 14. The method according to any of claims 1 to 13, further comprising the step of controlling the region of deposition by varying one or more of the rate of flow of the fuel, the separation between the first outlet and the substrate and the electric field between the first outlet and the substrate.
- 25 15. The method according to any of claims 1 to 14, wherein the material is deposited as a powder and the chemical reaction and/or decomposition occurs away from the substrate.
- 30

16. The method according to any of claims 1 to 14, wherein the material is deposited as a solid film and the chemical reaction and/or decomposition occurs in the vicinity of the substrate.
- 5 17. An apparatus for depositing material on a substrate, comprising:
a substrate holder for holding a substrate;
a nozzle assembly including an outlet from which a stream of droplets of a precursor liquid is in use delivered to a substrate;
a precursor supply for supplying a precursor liquid to the nozzle assembly;
10 an electrical supply for applying an electric field between the outlet and the substrate; and
a burner for generating a flame between the outlet and the substrate and being configured such that in use at least a portion of the stream of droplets of the precursor liquid passes through the flame before reaching the substrate and the
15 precursor liquid is chemically reacted and/or decomposed to provide the deposited material.
18. The apparatus according to claim 17, wherein the burner is provided by the
20 nozzle assembly and the nozzle assembly includes a second outlet from which an annular flow of fuel is in use delivered such as to provide an annular flame combustion region through which at least the portion of the stream of droplets passes before reaching the substrate, and further comprising a fuel supply for supplying fuel to the nozzle assembly.
- 25 19. The apparatus according to claim 18, wherein the first and second outlets are coaxial.
20. The apparatus according to claim 18 or 19, wherein the nozzle assembly further
30 comprises a third outlet disposed between the first and second outlets from which an annular flow of cold gas is in use delivered.

21. The apparatus according to claim 20, wherein the first and third outlets are coaxial.
22. The apparatus according to any of claims 18 to 21, wherein the first outlet is a central outlet.
23. The apparatus according to any of claims 17 to 22, further comprising a mesh disposed between the first outlet and the substrate.
24. The apparatus according to any of claims 17 to 23, further comprising an electrode at an electric potential between the potential of the first outlet and the substrate and disposed between the first outlet and the substrate.
25. The apparatus according to claim 24, wherein the electrode is an annular electrode.
26. The apparatus according to any of claims 17 to 25, further comprising a positioner for altering the relative position of the first outlet and the substrate.
27. The apparatus according to any of claims 17 to 26, where configured such that the chemical reaction and/or decomposition occurs away from the substrate so as to provide the material as a powder.
28. The method according to any of claims 17 to 26, where configured such that the chemical reaction and/or decomposition occurs in the vicinity of the substrate so as to provide the material as a solid film.

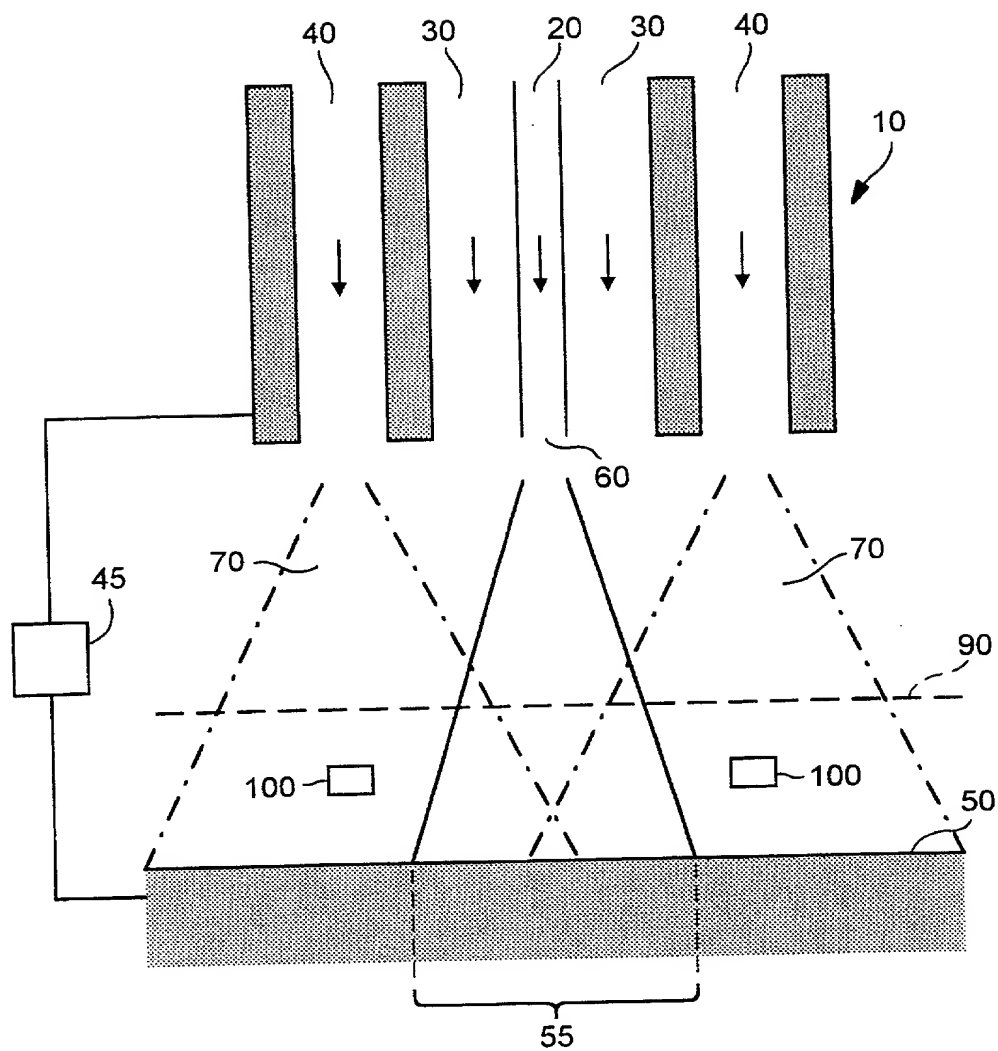


FIG. 1

DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY

(Includes reference to PCT International Applications)

FROMMER LAWRENCE & HAUG, LLP
File No.: 674505-2011

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original, first and joint inventor (if plural, names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention ENTITLED:

MATERIAL DEPOSITION

the specification of which:

- ☒ is attached hereto
- ☒ was filed with/transmitted to the USPTO on JUNE 1, 2000 as:
- ☒ United States Application Serial No. 09/555,544
- as the National Phase or Continuation or Continuation-in-Part of PCT Application No. PCT/GB98/03636, filed DECEMBER 07, 1998, designating the U.S., and published as WO 99/29917 on JUNE 17, 1999,
- ☒ with amendments through DATE EVEN HEREWITH (if applicable, give details).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code § 119 (a)-(d) or § 365 (b) of any foreign applications for patent or inventor's certificate, or § 365 (a) of any PCT International applications designating at least one country other than the United States of America listed below, and have also identified below any foreign applications for patent or inventor's certificate or any PCT International applications designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) on which priority is claimed:

Prior Foreign/PCT Application(s) [list additional applications on separate page]:

<u>Country (or PCT)</u>	<u>Application Number:</u>	<u>Filed</u>	<u>Priority Claimed:</u>	
			<u>Yes</u>	<u>No</u>
UK	9725878.4	DECEMBER 5, 1997	X	

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional applications listed below.

(Application Number)

(Filing Date)

I hereby claim the benefit under Title 35, United States Code § 120 of any United States applications or § 365 (c) of any PCT International applications designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior United States or PCT International applications in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

Prior U.S. (or U.S.-designating PCT) Application(s) [list additional applications on separate page]:

<u>U.S. Serial No.</u>	<u>Filed</u>	<u>PCT Application No.</u>	<u>Status (patented, pending, abandoned)</u>
	DECEMBER 7, 1998	PCT/GB98/03636	PENDING (THIS IS NAT'L PHASE)


I hereby appoint Thomas J. Kowalski, Registration No. 32,147, and FROMMER LAWRENCE & HAUG, LLP or their duly appointed associates, my attorneys or agents, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to file continuation and divisional applications thereof, to receive the patent, and to transact all business in the Patent and Trademark Office and in the Courts in connection therewith, and to insert the serial number of the application in the space provided above, and specify that all communications about the application are to be directed to the following correspondence address:

Thomas J. Kowalski, Esq.
c/o FROMMER LAWRENCE &
HAUG, LLP
745 Fifth Avenue
New York, NY 10151
Fax No.: (212) 588-0500

Direct all telephone calls to: (212) 588-0800
to the attention of:
Thomas J. Kowalski

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

INVENTOR(S):

1-00 Signature: 

Date: 12/6/2000

Full name of first inventor: Kwang-Leong CHOY

Residence: 35 Blondvil Street, Cheylesmore, Coventry, CB3 5EQ, United Kingdom GBX

Citizenship: Malaysian

Signature: 

Date: 12/6/2000

2-00 Full name of second inventor: Issac, Tsz, Hong, CHANG

Residence: 35 Blondvil Street, Cheylesmore, Coventry, CB3 5EQ, United Kingdom GBX

Citizenship: British

Post Office Address(es) of inventors [if different from residence]:

NOTE: In order to qualify for reduced fees available to Small Entities, each inventor and any other individual or entity having rights to the invention must also sign an appropriate separate "Verified Statement (Declaration) Claiming [or Supporting a Claim by Another for] Small Entity Status" form [e.g. for Independent Inventor, Small Business Concern, Nonprofit Organization, Individual Non-Inventor].